What is claimed is:

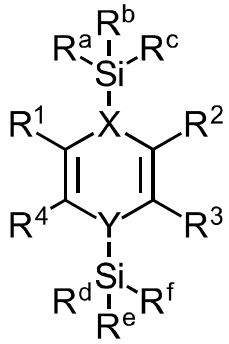
1. A method of depositing a film, the method comprising:

exposing at least a portion of a substrate surface to a first halide precursor comprising a compound having the general formula (I)

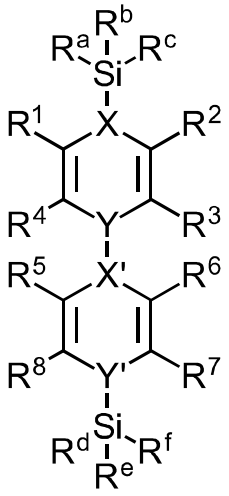
$$MQ_zR_m \qquad (\mathbf{I}),$$

wherein M is a metal selected from one or more of scandium (Sc), yttrium (Y), lanthanum (La), actinium (Ac), titanium (Ti), zirconium (Zr), hafnium (Hf), vanadium (V), niobium (Nb), tantalum (Ta), chromium (Cr), molybdenum (Mo), tungsten (W), manganese (Mn), rhenium (Re), technetium (Tc), iron (Fe), ruthenium (Ru), osmium (Os), cobalt (Co), rhodium (Rh), iridium (Ir), nickel (Ni), palladium (Pd), platinum (Pt), copper (Cu), silver (Ag), gold (Au), zinc (Zn), cadmium (Cd), mercury (Hg), tin (Sn), and silicon (Si), Q is a halogen selected from Cl, Br, F or I, z is from 1 to 6, R is selected from alkyl, CO, cyclopentadienyl, amidinate, diazadiene, or amidate, and m is from 0 to 6; and

exposing at least a portion of the substrate surface to an organosilane reactant comprising a compound of general formula (II) or general formula (III)



(II)



(III)

wherein R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^a, R^b, R^c, R^d, R^e, and R^f are independently selected from hydrogen (H), substituted alkyl or

unsubstituted alkyl; and X, Y, X', and Y' are independently selected from nitrogen (N) and carbon (C),

exposing at least a portion of the substrate surface to a second halide precursor comprising a compound having the general formula (I), wherein the second halide precursor is different from the first halide precursor; and

exposing at least a portion of the substrate surface to the organosilane reactant,

to deposit a metal film on the substrate surface, the metal film substantially free of carbon.

2. The method of claim 1, wherein Q is Cl or Br.

3. The method of claim 1, wherein Q is Cl.

4. The method of claim 1, wherein at least one of R^a, R^b, R^c, R^d, R^e, and R^f comprises methyl.

5. The method of claim 1, wherein exposing the substrate surface to the first halide precursor and the organosilane reactant occurs sequentially.

6. The method of claim 1, wherein exposing the substrate surface to the first halide precursor and the organosilane reactant occurs simultaneously.

7. The method of claim 1, wherein the organosilane reactant is selected from one or more bis(trimethylsilyl)cyclohexadiene, bis(trimethylsilyl)diaza-cyclohexadiene, bis(trimethylsilyl)-aza-cyclohexadiene, bis(trimethylsilyl)-dihydro-bipyridine, 3,6-bis(trimethylsilyl)-1,4-cyclohexadiene, 1-methyl-3,6-bis(trimethylsilyl)-1,4-cyclohexadiene, and 1,4-bis-(trimethylsilyl)-1,4-diaza-2,5-cyclohexadiene.

8. The method of claim 1, wherein the substrate is in a processing chamber.

9. The method of claim 8, further comprising purging the processing chamber of the first halide precursor and the second halide precursor prior to exposing the substrate to the organosilane reactant.

10. The method of claim 9, further comprising purging the processing chamber of the organosilane reactant.

11. The method of claim 10, wherein purging the processing chamber comprises flowing a purge gas into the processing chamber, the purge gas selected from one or more of nitrogen (N_2), helium (He), and argon (Ar).

12. A gate stack comprising:

a high-κ dielectric layer on a substrate;

a first titanium nitride layer on the high-κ dielectric layer;

a work-function layer on the first titanium nitride layer; and

a second titanium nitride layer on the work-function layer,

wherein the work-function layer comprises a metal film obtained using the method of claim 1.

13. A non-transitory computer readable medium including instructions, that, when executed by a controller of a processing chamber, causes the processing chamber to perform operations of:

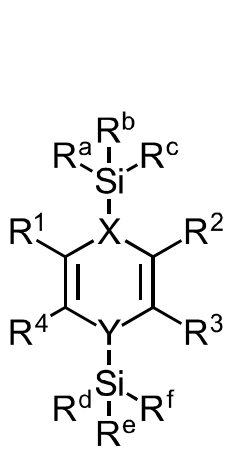
flow a first halide precursor into a processing volume of the processing chamber having a substrate, the first halide precursor having general Formula (I)

MQ_zR_m (**I**),

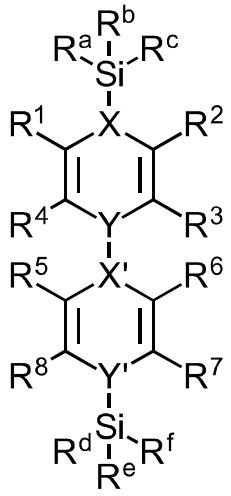
wherein M is a metal selected from one or more of scandium (Sc), yttrium (Y), lanthanum (La), actinium (Ac), titanium (Ti), zirconium (Zr), hafnium (Hf), vanadium (V), niobium (Nb), tantalum (Ta), chromium (Cr), molybdenum (Mo), tungsten (W), manganese (Mn), rhenium (Re), technetium (Tc), iron (Fe), ruthenium (Ru), osmium (Os), cobalt (Co), rhodium (Rh), iridium (Ir), nickel (Ni), palladium (Pd), platinum (Pt), copper (Cu), silver (Ag), gold (Au), zinc (Zn), cadmium (Cd), mercury (Hg), tin (Sn), and silicon (Si), Q is a halogen selected from Cl, Br, F or I, z is from 1 to 6, R is selected from alkyl, CO, cyclopentadienyl, amidinate, diazadiene, or amidate, and m is from 0 to 6,

purge the processing chamber of the first halide precursor;

expose the substrate to an organosilane reactant comprising a compound of general Formula (II) or general Formula (III):



(II)



(III)

wherein R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^a, R^b, R^c, R^d, R^e, and R^f are independently selected from hydrogen (H), substituted alkyl or unsubstituted alkyl; and X, Y, X', and Y' are independently selected from nitrogen (N) and carbon (C);

purge the processing chamber of the organosilane reactant;

flow a second halide precursor comprising a compound having the general formula (I) into the processing volume of the processing chamber, wherein the second halide precursor is different from the first halide precursor;

purge the processing chamber of the second halide precursor;

expose the substrate to the organosilane reactant; and

purge the processing chamber of the organosilane reactant.